

Remarks/Arguments:

Introduction

Claims 1-12 are pending. Claim 1 has been amended to describe the inert carrier as being a ceramic inert carrier. Support for this amendment may be found in the Specification at page 2, lines 17-20, which corresponds to paragraph [0009] of the published US patent application. Claims 7-12 have been amended to present the previously presented “use” claims as proper “method” claims. Additionally, claim 12 has been amended for proper antecedent basis.

No new matter is introduced with these amendments. Entry of the claim amendments is respectfully requested.

Claim Objections

Claim 12 was objected to under 37 C.F.R. §1.75(c) as failing to further limit the subject matter of the previous claims. Applicants respectfully submit that the amendments to claim 12 presented herein obviates the concerns raised by the Examiner.

Reconsideration and withdrawal of the objection to claim 12 is respectfully requested.

Section 112 Rejections

Claims 4 and 7-12 are rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. Claims 7-12 are rejected under 35 U.S.C. §101 as allegedly not reciting any process steps. Applicants respectfully traverse.

The Section 112 rejection of claim 4 was related to antecedent basis concerns raised by the Examiner. Applicants respectfully submit that the amendment to claim 1 presented herein obviates the concerns raised by the Examiner with respect to claim 4. Reconsideration and withdrawal of the Section 112 rejection of claim 4 is respectfully requested.

Claims 7-12 have been rewritten into proper form. In particular, the previously presented “use” claims have been rewritten into proper process claims, including proper process steps as suggested in the MPEP §2173.05(q). Reconsideration and withdrawal of the Section 112 & 101 rejections of claims 7-12 are respectfully requested.

Section 102 Rejections

Claims 1-3, 6-8, 10 and 11 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by EP 0 895 809 A1 to Satoru et al. (hereinafter “Satoru”). Applicants respectfully traverse.

Satoru discloses a niobium (Nb)-containing aqueous solution for use in producing a Nb-containing oxide catalyst. The oxide catalyst of Satoru is an oxide of a plurality of active component elements including Nb and is for use in a catalytic oxidation or ammoxidation of propane or isobutane in the gaseous phase. The oxide catalyst of Satoru is prepared by a mixing the Nb-containing aqueous solution with (an) aqueous mixture(s) containing compounds of active component elements of the oxide catalyst other than Nb, to thereby provide an aqueous compound mixture, and drying the aqueous compound mixture, followed by calcination.

Regarding claim 1 and claim 6, Satoru fails to disclose, teach or suggest the use of an inert carrier in the form of a powder. Applicants have found that there is a significant difference between catalysts that are made using a sol versus those that are made by using an inert carrier in the form of a powder.

Catalysts that are prepared using ceramic carrier powder have a particle density that is significantly higher than the catalyst that result from the use of sol. As indicated in the table in the specification, the pore structure of the Aerosil product (“AC”, based on dry powder and hence according to the current invention) has been analyzed and found to have an Apparent Particle Density (“APD”) of 1.5 g/mL or greater, whereas the Ludox based product (“LC”, which is an example similar to the product of Satoru) has an APD of 0.6 g/mL.

Transmission Electron Microscopy (TEM) Test Results

TEM characterization was conducted by Prof. John Geus at the facilities of the Catalyst Group of the Utrecht University¹. Of both materials, LC and AC, both dried and calcined, various representative pictures were taken and a selection of spots were analyzed. Of each spot the composition was measured, of which the results are given in the table below.

Appearance

AC (Figure 1): Consists mainly of small spheres (<10 micron) interspersed with irregularly shaped larger particles (up to 50 micron). Particles were generally smooth, but some seemed to have formed irregular structures on the surface, especially on the larger particles. These irregularities only showed up in the calcined material.

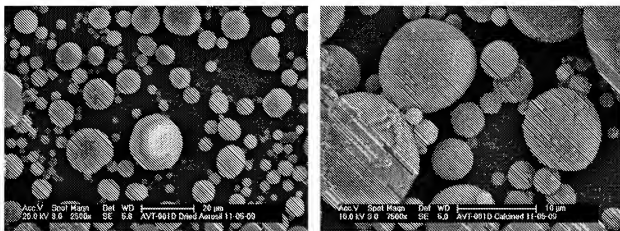


Figure 1. Aerisil catalyst: on the left is the dried catalyst, on the right the calcined catalyst.

LC (Figure 2): Mainly small particles, of which many had a doughnut shape. Most particles are <5 micron, only few are in the 10-20 micron range. However, the particle size distribution is similar to that of the AC, although the latter is wider (see Figure 3). Particles appear to have a smooth surface in the dried state, however, in the calcined state the surface is “mouldy” or rather “wrinkled” (dry apple).

¹ If needed, Applicants are willing to submit a declaration of Prof. John Geus attesting to the testing as described in this amendment and response.

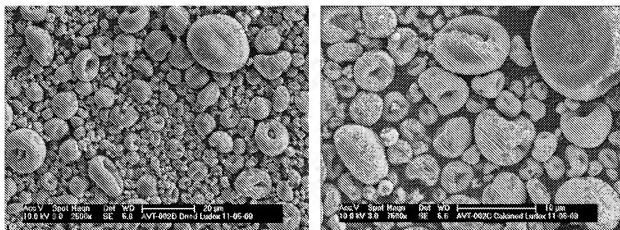
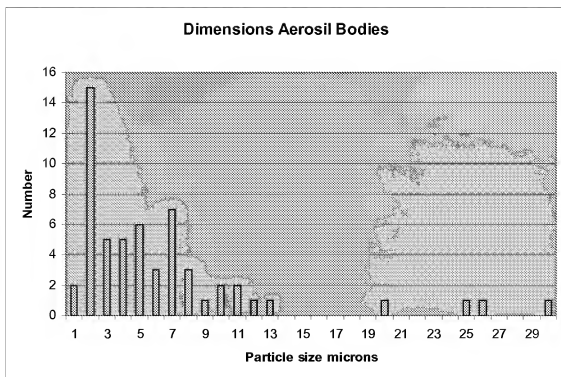


Figure 2. Ludox catalyst: on the left is the dried catalyst, on the right the calcined catalyst.

Particle size data are shown below in Figure 2, which includes two bar charts, as follows:



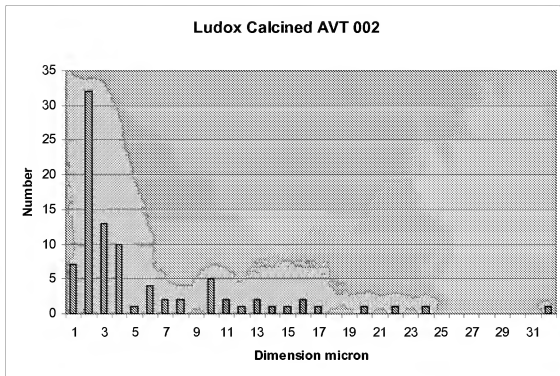


Figure 3. Particle size distribution based on counts in the pictures.
Top is the Aerosil catalyst, bottom is the Ludox catalyst.

Composition

Theoretical atomic ratio based on the recipe: Mo 1.00: V 0.30 : Te 0.23 : Nb 0.12.

Theoretical mass ratio: Si 23.4 : Mo 21.4 : V 3.4 : Te 6.6 : Nb 2.5.

The numbers in the tables are the averages of the spots.

Aerosil catalyst, dried: the composition is close to the expected theoretical value.

Aerosil catalyst, calcined: there is a considerable decrease in the amount of silica, and consequently an increase in the amount of metal species at the catalyst surface. Also there is

considerable enrichment in V and Te relative to Mo, while Nb remains more or less constant. It must also be said, however, that the data show considerable variation.

Table 1A. AC, dried (3 samples, 10, 7, and 10 spots)

	1		2		3	
	(%wt)	(%at)	(%wt)	(%at)	(%wt)	(%at)
Si	21.2		17.8		21.2	
Mo	21.3	1	24.8	1	21.3	1
V	3.0	0.26	3.4	0.26	3.0	0.26
Te	5.7	0.21	7.2	0.22	5.7	0.21
Nb	2.9	0.14	3.4	0.14	2.9	0.14

Table 1B. AC, calcined (3 samples, 10, 10, and 10 spots)

	1		2		3	
	(%wt)	(%at)	(%wt)	(%at)	(%wt)	(%at)
Si	11.7		7.1		16.2	
Mo	21.8	1	27.8	1	23.9	1
V	6.0	0.51	6.4	0.44	4.9	0.38
Te	10.5	0.36	10.8	0.30	5.7	0.18
Nb	2.4	0.11	3.7	0.14	4.3	0.18

Table 2A. LC, dried (2 samples, 7 and 10 spots)

	1		2		3	
	(%wt)	(%at)	(%wt)	(%at)	(%wt)	(%at)
Si	18.4		20.0			
Mo	17.0	1	18.7	1		
V	4.0	0.43	4.7	0.48		
Te	8.7	0.40	9.7	0.40		
Nb	4.0	0.25	5.0	0.26		

Table 2B. LC, calcined (2 samples, 10 and 8 spots)

	1		2		3	
	(%wt)	(%at)	(%wt)	(%at)	(%wt)	(%at)
Si	21.6		20.6			
Mo	17.6	1	18.3	1		
V	4.3	0.46	4.3	0.44		
Te	7.0	0.30	5.7	0.24		
Nb	3.2	0.19	3.9	0.21		

Ludox catalyst, dried: there is a slight decrease in the amount of both silica and Mo, but an increase in the amount of V, Te, and Nb.

Ludox catalyst, calcined: calcination doesn't appear to change the amounts of silica, Mo, and V. However, there is a pronounced decrease in the amounts of Te and Nb.

In the figures below the numbers of the tables were averaged.

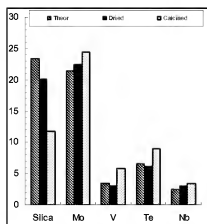


Figure 4A. Acrolyst catalyst

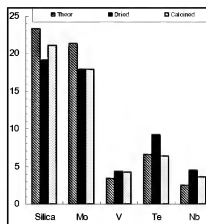


Figure 4B. Ludox catalyst

Conclusion

The TEM data show that the catalysts behave differently in the distribution of the metals over the catalyst surface upon drying and calcination.

The above analysis confirms that there is a difference between catalysts made by on the basis of a silica sol (as taught by Saturo et al, not claimed) and the method of the current invention, using an inert ceramic carrier in the form of a powder.

Regarding claims 2-3, 7-8, 10-12, Saturo teaches to use a catalyst that is made on the basis of a silica sol which is in direct contrast to the current invention.

Accordingly, Saturo fails to disclose the subject matter as presented in claims 1-3, 6-8, 10 and 11. Therefore, reconsideration and withdrawal of the rejection of claims 1-3, 6-8, 10 and 11 under 35 U.S.C. §102(b) over Saturo are respectfully requested.

Claims 1-4, 6 and 9 are rejected under 35 U.S.C. §102(a) as allegedly being anticipated by EP 1 358 932 A1 to Han et al. (hereinafter "Han"). Applicants respectfully traverse.

Han discloses a supported catalyst comprising a mixed metal oxide that is useful for the vapor phase catalytic partial oxidation of an alkane, or a mixture of an alkane and an alkene, to an unsaturated carboxylic acid and for the vapor phase ammoxidation of an alkane, or a mixture of an alkane and an alkene, to an unsaturated nitrile.

Regarding claims 1 and 6, Han fails to disclose, teach or suggest the preparation of a catalyst supported on a carrier. Instead, Han is proposing a physical mix of the mixed metal oxide and, if desired, a support by use of a (wet) grinding process.

As readily apparent to one of ordinary skill in the art, the result of Han is a physical mix that is entirely different from the product of the method of Satoru et al and/or of the method of the current invention. With reference to Comparative Examples 2 and 3 of the current patent application, it is known that the catalysts according to the current invention outperform catalysts that are not supported on a carrier.

Regarding claims 2-4, and 9, Han fails to disclose, teach or suggest the use of a catalyst supported on a carrier.

Accordingly, Han fails to disclose the subject matter as presented in claims 1-4, 6 and 9. Therefore, reconsideration and withdrawal of the rejection of claims 1-4, 6 and 9 under 35 U.S.C. §102(a) over Han are respectfully requested.

Section 103 Rejections

Claims 9 and 12 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Satoru in further view of US 5,380,933 to Ushikubo et al. (hereinafter "Ushikubo"). Applicants respectfully traverse.

With the Examiner, Applicants agree that Satoru teaches a Nb containing catalyst which can be used for the production of (meth) acrylic acid or (meth) acrylonitrile in high yield.

Surprisingly, the current Inventors have found that improved catalytic activity and/or selectivity can be obtained when an inert carrier is provided in a ceramic form rather than in the form of a sol. As indicated in Table 1 of the current patent application, the catalysts that are prepared using ceramic carrier powder have a particle density that is significantly higher than the catalyst that result from the use of a sol. The catalyst activity per catalyst volume after shaping will therefore be higher from the catalysts prepared from ceramic carrier powder.

That a higher particle density and hence an improved catalyst could be obtained using a carrier in ceramic form, i.e., a dry powder form, is not known from Satoru. Indeed, one of ordinary skill in the art at the time of the subject invention has no reason to expect any improvement, as Satoru teaches the opposite: to use a silica sol.

Regarding claims 9 and 12, Ushikubo et al (US5380933) teaches a method for producing an unsaturated carboxylic acid, which includes subjecting an alkane to a vapor phase catalytic oxidation reaction in the presence of a catalyst containing a mixed metal oxide comprising, as essential components, Mo, V, Te, O and X where X is at least one element selected from the group consisting of niobium, tantalum, tungsten, titanium, aluminum, zirconium, chromium, manganese, iron, ruthenium, cobalt, rhodium, nickel, palladium, platinum, antimony, bismuth, boron, indium and cerium, and where the proportions of the respective essential components, based on the total amount of the essential components exclusive of oxygen, satisfy the following formulas: $0.25 < r_{Mo} < 0.98$ $0.003 < r_V < 0.5$ $0.003 < r_{Te} < 0.5$ $0.003 < r_X < 0.5$ where r_{Mo} , r_V , r_{Te} and

r_X are molar fractions of Mo, V, Te and X, respectively, based on the total amount of the essential components exclusive of oxygen.

According to Ushikubo at column 3, lines 25 and further, the mixed metal oxide is to be prepared by the following method. For example, when a mixed metal oxide of the formula $Mo_a V_b Te_c Nb_x O_n$ wherein the element X is Nb, is to be prepared, an aqueous solution of telluric acid, an aqueous solution of ammonium niobium oxalate and a solution or slurry of ammonium paramolybdate are sequentially added to an aqueous solution containing a predetermined amount of ammonium metavanadate, so that the atomic ratio of the respective metal elements would be in the prescribed proportions, the mixture is then dried by e.g. evaporation to dryness, spray drying or vacuum drying, and finally the remaining dried product is calcined usually at a temperature of from 350 ° to 700 °C, preferably from 400 ° to 650 °C usually for from 0.5 to 30 hours, preferably from 1 to 10 hours, to obtain the desired mixed metal oxide.

Moreover, at column 4, line 44 and further, the mixed metal oxide thus obtained may be used by itself as a solid catalyst, but may be formed into a catalyst together with a suitable carrier such as silica, alumina, titania, aluminosilicate, diatomaceous earth or zirconia. Further, it may be molded into a suitable shape and particle size depending upon the scale or system of the reactor.

Accordingly, Ushikubo fails to teach or suggest the use of a catalyst supported on an inert carrier in the form of a ceramic carrier powder. From the above it follows that one of ordinary skill in the art at the time of the subject invention, when combining the teachings of Satoru and Ushikubo would not have had any incentive to produce a catalyst supported on an inert carrier, let alone a carrier in the form of a dry powder.

Thus, Satoru and Han, individually or in combination, fail to teach or suggest the invention as presently defined in claims 9 and 12. Therefore, reconsideration and withdrawal of the rejections of claims 9 and 12 under 35 U.S.C. §103(a) are respectfully requested.

Claim 5 is rejected under 35 U.S.C. §103(a) as allegedly being obvious over Han. Applicants respectfully traverse.

Regarding claim 5, it is reiterated that Han teaches a catalyst combined with a support, but not on a support. Starting from Han, one of ordinary skill in the art at the time of the subject invention would have had no incentive to use a catalyst supported on an inert carrier. The mere grinding process hence does not lead to a method as claimed in claim 5.

Accordingly, Han fails to teach or suggest the invention as presently defined in claim 5. Therefore, reconsideration and withdrawal of the rejection of claim 5 under 35 U.S.C. §103(a) is respectfully requested.

Conclusion

Claims 1-3, 6-8 and 10-11 were rejected under 35 USC § 102(b) as being anticipated by Satoru. The differences between the catalysts as prepared using a silica sol and an inert carrier in the form of a powder have been emphasized, with photographs of the products of the two methods as additional evidence to support the Applicants' arguments. Claims 1-4, 6, and 9 were rejected under 35 USC § 102(a) as being anticipated by Han. Han advocates the use of a catalyst wherein optionally the metal oxides are grinded together with a support. This does not yield a supported catalyst as prepared by Satoru or as prepared by the current inventors. Both references therefore do not anticipate the current invention, nor render the current invention obvious to one of ordinary skill in the art.

Summary

Therefore, Applicants respectfully submit that claims 1-12 are patentably distinct. This application is believed to be in condition for allowance. Favorable action thereon is therefore respectfully solicited.

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Amendment and Response dated October 1, 2009
Reply to Office Action of April 1, 2009
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Should the Examiner have any questions or comments concerning the above, the Examiner is respectfully invited to contact the undersigned attorney at the telephone number given below.

The Commissioner is hereby authorized to charge payment of any additional fees associated with this communication, or credit any overpayment, to Deposit Account No. 08-2461. Such authorization includes authorization to charge fees for extensions of time, if any, under 37 C.F.R § 1.17 and also should be treated as a constructive petition for an extension of time in this reply or any future reply pursuant to 37 C.F.R. § 1.136.

Respectfully submitted,

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